In the Specification

Replace the paragraph at page 9, lines 7 through 17 with the below paragraph.

a1

In a further embodiment, upstream biasing affects which ions flow to the filter. For example, a sample flows into an ionization region subject to ionization source, and electrodes are biased to deflect and affect flow of the resulting ions. Positive bias on a deflection electrode repels positive ions toward the filter and attracting electrodes being negatively biased attract the positive ions into the central flow of the ion filter, while negative ions are neutralized on the deflection electrode and which are then swept out of the device. Negative bias on the deflection electrode repels negative ions toward the filter and attracting electrodes positively biased attract the negative ions into the central flow path of the filter, while positive ions are neutralized on the deflection electrode.

Replace the paragraph at page 10, lines 15 through 21 with the below paragraph.

a2

In various embodiments of the invention, a spectrometer is provided where a plurality of electrodes are used to create a filter field and a propulsion field, in a cooperative manner that may feature simultaneous, iterative or interactive use of electrodes. Where a plurality of electrodes face each other over a flow path, the filter field and the propulsion field may be generated using the same or different members of the electrode plurality. This may be achieved in a simple and compact package.

Replace the paragraph at page 14, lines 1 through 6 with the below paragraph.

a3

The system is preferably driven by electronic controller 30, which may include, for example, amplifier 34 and microprocessor 36. Amplifier 34 amplifies the output of detector 32, which is a function of the charge collected by electrode 35 and provides the output to

a3 End

microprocessor 36 for analysis. Similarly, amplifier 34′, shown in phantom, may be provided where electrode 33 is also utilized as a detector.

Replace the paragraph at page 15, lines 8 through 23 with the below paragraph.

a4

In an alternative practice of the invention, the duty cycle of the asymmetric periodic voltage applied to electrodes 20 and 22 of filter 24 is varied so that there is no need to apply a compensation voltage. The control electronics varies the duty cycle of asymmetric alternating electric field 25, with the result that path of a selected ion species (defined mostly by charge and cross-section, among other characteristics, of the ions) is returned toward the center of the flow path, and so to pass on for detection. As an example, and not by way of limitation, the duty cycle of field 25 may be one quarter: 25% high, peak 70, and 75% low, valley 72; in which case, ions 19 on path 42a approach and collide with a filter electrode 20 and are neutralized (Fig. 3A). However, by varying the duty cycle to 40%, peak 70a, 60% low, valley 72a, ions 19' on path 42c pass through filter 24 and toward the detector without being neutralized (Fig. 3B). Typically the duty cycle is variable from 10-50% high and 90-50% low Accordingly, by varying the duty cycle of field 25 an ion's path in field 25 may be corrected so that it will pass through filter 24 without being neutralized and without the need for a compensating bias voltage.

Replace the paragraph at page 16, lines 16 through 23 with the below paragraph.

a5

To improve FAIMS spectrometry resolution even further, detector 32 may be segmented, as shown in Fig. 4. As ions pass through filter 24 between filter electrodes 20 and 22, the individual ions 19′-19″″ may be detected spatially, the ions having their trajectories 42c′-42c″″ determined according to their size, charge and cross section. Thus detector segment 33' will have a concentration of one species of ion while detector segment 33″ will have a different ion species concentration, increasing the spectrum resolution as each segment may detect a particular ion species.

Replace the paragraph at page 16, lines 24 through 27 and page 17 lines 1 through 5 with the below paragraph.

A6 A PFAIMS spectrometer as set forth herein is able to detect and discriminate between a wide range of compounds, and can do so with high resolution and sensitivity. As shown in Fig. 5A, varying concentrations of acetone that were clearly detected in one practice of the invention, with definitive data peaks 46 at -3.5 volts compensation. These were detected even at low concentrations of 83 parts per billion. With the bias voltage set at -6.5 volts, Fig. 5B, varying concentrations of di-ethylmethyl amine were clearly detected in practice of the invention, generating data peaks 48; these were detected in concentrations as low as 280 parts per billion.

Replace the paragraph at page 17, lines 22 through 25 with the below paragraph.

A7 Embodiments of the invention are compact with low parts count, where the substrates and spacers act to both contain the flow path and also for a structural housing of the invention. Thus the substrates and spacers serve multiple functions, both for guiding the ions and for containing the flow path.

Replace the paragraph at page 19, lines 1 through 15 with the below paragraph.

A8 Dual chamber embodiment 10x of the invention, Fig. 8, has two enclosed flow paths 26', 26" coupled by passageway 63. The gas sample 12 enters inlet 16a and is ionized at ionization region 17 in the lower flow path 26', ionized by any ionization device, such as an internal plasma source 18a. The ions are guided toward ion filter 24a in upper flow path 26" through passageway 63 by electrodes 56ax and 56bx, which act as steering or deflecting electrodes, and may be defined by confining electrodes 56a, 56b (discussed earlier). As these ions 42c pass between ion filter electrodes 20a and 22a, undesirable ions will be neutralized by hitting the filter electrodes while selected ions will pass through filter 24a to be detected by detector 32a, according to the applied RF and compensation. By deflecting ions out of the gas flow, a preliminary filtration is effected, wherein the non-deflected ions and non-ionized

a8 End

sample and associated carrier gas will be exhausted at outlet 16x'. The exhaust gas 43 from upper flow path 26", at outlet 16x", may be cleaned, filtered and pumped via pump part 14 and returned at inlet 16b as clean filtered gas 66 back into the flow path 26". In one practice of the invention, clean dry air may introduced into the flow path via pump 14.

Replace the paragraph at page 19, lines 16 through 23 with the below paragraph.

a9

Drawing in clean dry air assists in reducing the FAIMS spectrometer's sensitivity to humidity. Moreover, if the spectrometer is operated alternately with and without clean dry air, and with a known gas sample introduced into the device, then the device can be used as a humidity sensor since the resulting spectrum will change with moisture concentration from the standardized spectrum for the given known sample.

Replace the paragraph at page 20, lines 10 through 19 with the below paragraph.

a10

Another advantage of the embodiment of Fig. 8 is that the dynamic range of the PFAIMS detector can be extended when employing a front end device (such as a GC, LC or electrospray for example). In one practice of the invention, by adjusting the ratios of the drift gas and GC-sample/carrier gas volume flow rates coming into ionization region 17, the concentration of the compounds eluting from the GC can be controlled/diluted in a known manner so that samples are delivered to the PFAIMS ion filter 24a at concentrations which are optimized for the PFAIMS filter and detector to handle. In addition, steering electrodes 56ax, 56bx can be pulsed or otherwise controlled to determine how many ions at a given time enter into flow path 26".

Replace the paragraph at page 23, lines 13 through 22 with the below paragraph.

a11

In the embodiment of the invention shown in Fig. 11, ion filter 240 includes spaced electrodes 276 and 277 for creating transverse filter field 242. The ion flow generator 250 includes spaced discrete electrodes, such as electrode pairs 282-284 and 286-288, for generating longitudinal transport field 252. In one practice, electrodes 282 and 284 are at 1000 volts and electrodes 286 and 288 are at 0 volts. Insulating medium 290 and 291 insulates electrodes 282, 284, 286, and 288 with respect to electrodes 276 and 277. Electrode pair 282-284 could also be coupled as a single ring electrode and electrode pair 286-288 could be coupled as a single ring electrode in a cylindrical embodiment of the invention.

Replace the paragraph at page 26, lines 3 through 12 with the below paragraph.

a12

In still another embodiment, spectrometer embodiment 359 shown in Fig. 16 includes RF electrodes 360, 362, which provide the asymmetric ion filtering electric field 242 which are disposed on the outside walls of insulative substrates 52, 54. Resistive layers 370 and 372 may be a resistive ceramic material deposited on the inside walls of insulating substrates 52 and 54, respectively. Terminal electrodes 374-375, and 377-378 make contact with each resistive layer and are shown to enable a voltage drop across each resistive layer to generate the ion propelling longitudinal electric field 252. Thus, electrodes 374 and 377 may each be at -100 volts while electrodes 375 and 378 are at -1000 volts, for example.

Replace the paragraph at page 26, lines 13 through 23 with the below paragraph.

a13

In the embodiment of Fig. 17, spectrometer 379 has discrete electrodes 380-386 on substrate 52 and 387-393 on substrate 54 which cooperate to produce an electrical field or fields. The net effect provides both transverse and longitudinal field components to both filter and propel the ions. A traveling wave voltage of the form

Vcos (wt-kz)

A13 End

where $k = 2\pi/\lambda$ is the wave number has an associated electric field with both transverse and longitudinal components 242+252. For a planar system, each succeeding set of opposing electrodes is excited by a voltage source at a fixed phase difference from the voltage source applied to the adjacent set of opposing electrodes.

Replace the paragraph at page 27, lines 5 through 18 with the below paragraph.

A14

In an alternative of the embodiment of Fig. 17, the discrete electrodes 380-386 and 387-393 are still driven to produce both transverse and longitudinal fields to both filter and propel the ions. The PFAIMS RF signal is applied to the electrodes to generate the transverse RF field, which may involve one electrode on each substrate or multiple electrodes. Compensation is also generated, either by varying the duty cycle or the like of the RF, or by applying a DC bias to the electrodes, which may involve one electrode on each substrate or multiple electrodes. Finally, the ion flow generator includes a selection of these electrodes biased to different voltage levels (e.g., 1000vdc on electrodes 380 and 387 and 100vdc on electrodes 386 and 393) to generate a gradient along the flow path. Compensation voltage applied to the RF filter field opens the filter to passage of a desired ion species if present in the sample as propelled by the flow generator. If the compensation voltage is scanned, then a complete spectrum of the compounds in a sample can be gathered.

Replace the paragraph at page 28, lines 10 through 20 with the below paragraph.

A15

In an illustrative embodiment, upstream biasing affects which ions flow to the filter. For example, a sample S flows ("IN") into an ionization region 415 subject to ionization source 416. Electrodes 417, 418, 419 are biased to deflect and affect flow of the resulting ions. Positive bias on electrode 419 repels positive ions toward the filter and electrodes 417, 418 being negatively biased attract the positive ions into the central flow of filter 420, while negative ions are neutralized on electrode 419 and which are then swept out ("OUT") of the region. Negative bias on electrode 419 repels negative ions toward the filter and electrodes